

High Effectiveness Heat Exchanger for Cryogenic Refrigerators, Phase I

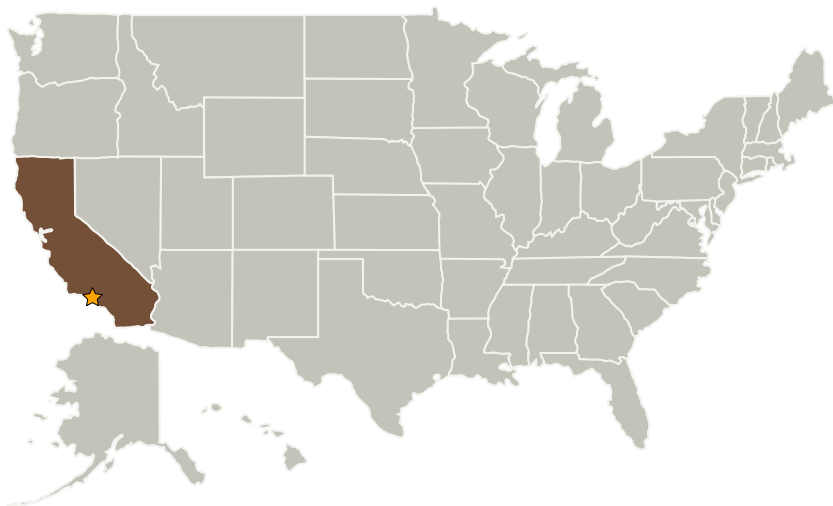
Completed Technology Project (2005 - 2005)



Project Introduction

We propose an innovative high performance cryogenic heat exchanger manufactured of titanium by photo-etching and diffusion bonding. This is a parallel plate design of thin laminated titanium foils. Titanium is used because of its low thermal conductivity which allows more compact heat exchangers with lower parasitic heat loss. Photo-etched patterns in the foils create the flow passages for the hot and cold flows with solid barrier foils separating the streams. A difficult problem with high performance heat exchangers is balancing the mass flow rate between multiple flow passages required for all but the smallest levels of cooling; this problem can degrade exchanger ineffectiveness by factors of more than 3. Our manufacturing technique allows us to include flow balancing features within the flow passages to automatically balance the flow rates. Recuperative cycle cryocoolers, such as reverse Brayton, Joule-Thomson or their hybrids, require high effectiveness heat exchangers to reach cryogenic temperatures. Higher effectiveness leads directly to improved system efficiency or allows lower temperatures to be reached. Improved heat exchanger performance will directly lead to lower input power cryocoolers particularly for the 4-10 K temperature range where cryocooler system efficiencies are very low.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Micro Cooling Concepts, Inc.	Supporting Organization	Industry Veteran-Owned Small Business (VOSB)	Huntington Beach, California

Primary U.S. Work Locations

California

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jack M Fryer

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors